[MHE201] DESIGN, CALCULATION AND VERIFICATION OF MACHINES

GENERAL INFORMATION

Studies	UNIVERSITY MASTER IN INDUSTRIAL ENGINEERING			**Subject**	?
Semester	2	**Course**	1	**Mention / Field of specialisation**	
Character	COMPULSORY				
Plan	2022	**Modality**	Face-to-face	**Language**	CASTELLANO
Credits	5,5	**Hours/week**	3.5	**Total hours**	63 class hours + 74.5 non-class hours = **137.5 total hours**

2030 AGENDA GOALS

PROFESSORS

GALFARSORO ANDUAGA, UNAI
ULACIA GARMENDIA, IBAI
MCCLOSKEY GOMEZ, ALEX
OYANGUREN GARCIA, AITOR

REQUIRED PREVIOUS KNOWLEDGE

Subjects	Knowledge
MATERIAL ELASTICITY AND STRENGTH	*(No previous knowledge required)*
GRAPHIC EXPRESSION II	
MACHINE AND MECHANISM THEORY	
[!] *FISICA I*	

LEARNING RESULTS

LEARNING RESULTS	KC	SK	AB	ECTS
MHRA03 - To design and perform machine tests		x		3,9
MHRA22 - To demonstrate knowledge and capabilities to carry out verification and control of facilities, processes and products		x		0,52
MHRA23 - To demonstrate knowledge and capabilities to carry out certifications, audits, verifications, tests and reports		x		0,52
MHRA27 - To demonstrate the ability to integrate knowledge and face the complexity of formulating judgments based on information that, being incomplete or limited, includes reflections on the social, health and safety, environmental, economic and industrial implications and responsibilities		x		0,08
MHRA28 - To communicate your conclusions and the knowledge and ultimate reasons that support them to specialized and non-specialized audiences in a clear and unambiguous way		x		0,08
MHRA30 - To work with people, involving and directing them in a dynamic aimed at a common objective that includes reflection on their ethical and social responsibility, with a global vision of the work to be carried out and the characteristics that it requires (quality, deadlines,...), assuming responsibility for the decisions made		x		0,08
MHR126 - To apply the knowledge acquired and your problem-solving skills in new, little-known or changing environments within broader (or multidisciplinary) contexts related to your area of study		x		0,16
MHR129 - To possess the learning skills that allow them to continue studying in a way that will be largely self-directed or autonomous		x		0,16
			Total:	**5,5**

KC: Knowledge or Content / SK: Skills / AB: Abilities

ENAEE LEARNING RESULTS	ECTS
ENA123 - Knowledge and comprehension: Deep knowledge and comprehension of mathematics and other basic sciences inherent in their engineering speciality, allowing them to achieve the other competencies of the degree.	0,5
ENA124 - Knowledge and comprehension: Deep knowledge and comprehension of the engineering disciplines of their speciality, at the level necessary to acquire the rest of the competencies of the degree.	0,5
ENA126 - Knowledge and comprehension: Critical knowledge of the broad multidisciplinary context of engineering and the interrelations existing between the knowledge of the different fields.	0,5
ENA128 - Analysis in engineering: Ability to conceive new products, processes, and systems.	0,7
ENA134 - Research and innovation: Ability to carry out bibliographic searches and consult and use databases and other information sources with discretion, in order to carry out simulations with the aim of conducting research on complex topics of their speciality.	0,5
ENA136 - Research and innovation: High-level capacity and ability to project and carry out experimental investigations, interpret data with criteria, and draw conclusions.	0,6
ENA139 - Practical application of engineering: Practical skills, such as the use of computer tools to solve complex problems, carry out complex engineering projects, and design and guide complex investigations.	0,6
ENA140 - Practical application of engineering: Complete knowledge of application of materials, equipment and tools, engineering technology and processes, and their limitations.	0,6

ENA142 - Practical application of engineering: Knowledge and comprehension of the social, health and safety, environmental, economic and industrial implications of engineering practice.	0,5
ENA147 - Communication and Teamwork: Ability to operate effectively in domestic contexts as a member or leader of a team, which may be composed of people of different disciplines and levels, and who can use virtual communication tools.	0,5
Total:	**5,5**

SECONDARY LEARNING RESULTS

RMH124 **[!]** ***Dimensiona mecanismos de transmisión de movimiento en base a levas y en base a engranes***

LEARNING ACTIVITIES	CH	NCH	TH
Personal study and flexible development of concepts and subjects using active dynamics, to foster more meaningful learning		18 h.	18 h.
Conducting tests, giving presentations, presenting defences, taking examinations and/or doing checkpoints	3 h.		3 h.
Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects	19 h.		19 h.
Carrying out exercises and solving problems individually and/or in teams	4 h.	11 h.	15 h.

EVALUATION SYSTEM	W	MAKE-UP MECHANISMS
Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems	10%	Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems
Presentation and defence of exercises, case studies, computer practical work, simulation practical work, laboratory practical work, term projects, end of degree project, master's thesis, challenges and problems	30%	Presentation and defence of exercises, case studies, computer practical work, simulation practical work, laboratory practical work, term projects, end of degree project, master's thesis, challenges and problems
Individual written and/or oral tests or individual coding/programming tests	60%	Individual written and/or oral tests or individual coding/programming tests

CH - Class hours: 26 h.
NCH - Non-class hours: 29 h.
TH - Total hours: 55 h.

RMH125 **[!]** ***Modeliza, ensaya y verifica elementos mecánicos y sistemas de transmisión***

LEARNING ACTIVITIES	CH	NCH	TH
Personal study and flexible development of concepts and subjects using active dynamics, to foster more meaningful learning		21 h.	21 h.
Conducting tests, giving presentations, presenting defences, taking examinations and/or doing checkpoints	5 h.		5 h.
Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects	20 h.		20 h.
Carrying out exercises and solving problems individually and/or in teams	2,5 h.	6,5 h.	9 h.

EVALUATION SYSTEM	W	MAKE-UP MECHANISMS
Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems	10%	Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems
Individual written and/or oral tests or individual coding/programming tests	90%	Individual written and/or oral tests or individual coding/programming tests

CH - Class hours: 27,5 h.
NCH - Non-class hours: 27,5 h.
TH - Total hours: 55 h.

RMH126 **[!]** ***Diseña, calcula y verifica mecanismos de transmisión de movimiento en máquinas partiendo de las***

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LEARNING ACTIVITIES	CH	NCH	TH
Development and writing of records, reports, presentations, audiovisual material, etc. on projects/work experience/challenges/case studies/experimental investigations carried out individually and/or in teams		7,5 h.	7,5 h.
Carrying out/resolving projects/challenges/cases, etc. to provide solutions to problems in interdisciplinary contexts, real and/or simulated, individually and/or in teams	4,5 h.	10,5 h.	15 h.
Carrying out work experience in real environments and writing the corresponding report	5 h.		5 h.

EVALUATION SYSTEM	W	MAKE-UP MECHANISMS
Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems	50%	Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems
Presentation and defence of exercises, case studies, computer practical work, simulation practical work, laboratory practical work, term projects, end of degree project, master's thesis, challenges and problems	50%	Presentation and defence of exercises, case studies, computer practical work, simulation practical work, laboratory practical work, term projects, end of degree project, master's thesis, challenges and problems

CH - Class hours: 9,5 h.
NCH - Non-class hours: 18 h.
TH - Total hours: 27,5 h.

CONTENTS

1.- Design and calculation of non-commercial machine elements - Cams -Design process -Kinematics -Sizing and verification - Gears -Geometry definition for cylindrical gears with straight teeth, -Application to helical teeth, -Motion and torque transmission, -Sizing by means of standards and calculation tools. -Lubrication conceptsModeling of transmission systems - Concentrated parameter models - FE models3.- Machine testing and verification - Machine in operation - Frequencies related to rotating mechanical elements - Frequencies related to different types of failures - Perform FFTs and interpret the information - Machine stopped - Natural frequencies - Vibration modes - Experimental set-up for measurement - Dynamic response - Vibration severity standards

LEARNING RESOURCES AND BIBLIOGRAPHY

Learning resources

Subject notes
Technical articles
Moodle Platform
Class presentations
Lab practical training
Specific Master Software

Bibliography

"Elementos de máquinas", B. J. hamrock, B. Jacobson, S. R. Schmid, Ed. Mcgraw-Hill

"134 Problemas de teoría de máquinas y mecanismos", P. R. Moliner, CPDA-ETSEIB

"Engranajes", P. R. Moliner, CPDA-ETSEIB

"Cam design handbook", Harold A. Rothbart, Ed, McGraw-Hill

"Cam Design", Clyde H. Moon, Camco

"Elementos de máquinas"; G. Niemann; Editorial LABOR

Norton RL. Diseño de máquinas. Pearson; 1999.

Shigley JE, Mischke CR, Bocanegra FP, Correa CO. Diseño en ingeniería mecánica. México; McGraw-Hill; 2002

Erdman AG, Sandor GN. Mechanism design: analysis and synthesis (Vol. 1). Prentice-Hall, Inc.; 1997

Decker KH, Manual del ingeniero; 13. Elementos de máquinas. Urmo; 1980.

Norma ISO 6336: Calculation of load capacity of spur and helical gears.

Henriot G. Traité théorique et pratique des engrenages. Dunond; 1975

Campabadal J. Engranajes. Primera Editorial Ariel. 1969.

Schrock J. Montaje ajuste y verificación de elementos de máquinas. Reverte; 1965

Tlusty J. Manufacturing processes and equipment. Prentice Hall; 2000.